

Calculating Volumes

To answer these questions you must know that a mass of M_r in grams, of any gas, will always occupy 24 litres (that's 24,000 cm³) at room temperature and pressure (RTP)

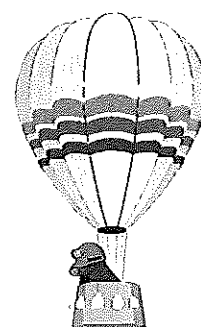
RTP is...

25°C

1 atmosphere pressure.

If you are asked to convert a mass of gas to a volume of gas, first you need to be able to convert the mass to moles — or simply remember this equation:

$$\frac{\text{Volume of gas (in cm}^3\text{)}}{24,000} = \frac{\text{Mass of gas}}{M_r \text{ of gas}}$$



Look at this example:

What is the volume of 0.2g of H₂?

$$\frac{\text{Vol. of gas}}{24,000} = \frac{0.2}{2}$$

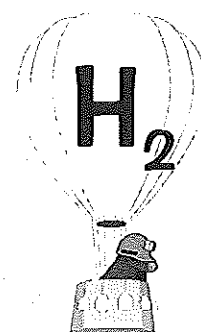
$$\text{Vol. of gas} = \frac{0.2 \times 24,000}{2} = 2,400 \text{ cm}^3$$

Q1 Find the volume at RTP of the following:

- a) 8g of helium (He) in litres
- b) 4g of argon (Ar) in litres
- c) 8.4g of krypton (Kr) in litres
- d) 2.6g of xenon (Xe) in cm³
- e) 32g of oxygen (O₂) in cm³
- f) 7.1g of chlorine (Cl₂) in cm³

Q2 Find the volume at RTP of the following:

- a) 11g of CO₂ in litres
- b) 40g of CH₄ in litres
- c) 8g of SO₃ in cm³
- d) 25.5g of NH₃ in cm³
- e) 131.75g of CH₃NH₂ in cm³ (don't know if that's a gas at RTP, but I liked the look of it)



Calculating Volumes

If the question gives you the volume and asks you for the mass, you can get it from the equation at the top of the last page. Practise on these ones.

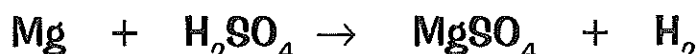
Q3 Find the mass of the following volumes of gas (they're at RTP):

- a) 24 litres of He
- b) 3 litres of He
- c) 18 litres O_2
- d) 2000 cm^3 of O_3
- e) 3000 cm^3 of H_2

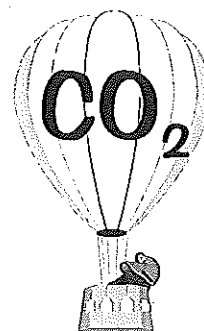
Q4 Find the mass of the following volumes of gas (they're at RTP):

- a) 24 litres of C_2H_4
- b) 30 litres of NH_3
- c) 6200 cm^3 SO_2
- d) 9600 cm^3 of CH_3NH_2 (still don't know if that's a gas at RTP, but still like the look of it)

Q5 Consider the equation:



- a) Calculate the mass of hydrogen produced when 2.4g of magnesium reacts completely with the acid.
- b) Calculate the volume of hydrogen produced at RTP in part a).
- c) Calculate the mass of magnesium required to produce 4g of hydrogen.
- d) Calculate the volume of 4g of hydrogen.
- e) Calculate the mass of magnesium required to produce 1,200 cm^3 of hydrogen.



Top Tips: Volume doesn't depend on type of gas. Temperature and pressure affect it, but they'll be constant in Exam questions — probably RTP (make sure you can define this). Don't think you can forget tricky stuff like this, 5% of the Exam could be on it — pretty much a grade... so keep practising, until you get them ALL right each time.